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Americas Conference on Information Systems (AMCIS)

8-15-1997

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Kecheng Liu
Staffordshire University, K.Liu@soc.staffs.ac.uk

Jatinder N.D Gupta
Ball State University, jgupta@bsuvc.bsu.edu

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Kecheng Liu
Staffordshire University
Beaconside, Stafford
ST18 ODA, UK
Phone: +44.1785.353464
K.Liu@soc.staffs.ac.uk
Jatinder N.D. Gupta
Ball State University
Muncie, Indiana 47306, USA
+1.317.2855301
jgupta@bsuvc.bsu.edu

Cooperative Systems Design

Information systems design is a task involving many disciplines and participation of multiple interested parties. An increasingly acceptable view is that Information Systems have many interacting components, such as people, work procedures, and technology. The activities of people will take place within a boundary that separate those components relevant to the system (for example, to do with the payment of employees in a payroll system) and those concerned with the environment around the system (other information systems, customers, suppliers, governments and so on) (Avison and Fitzgerald, 1995). Therefore designing such an information system will involve the design of technical, computer-based system, as well the organisation, particularly the work procedures around the computer systems.

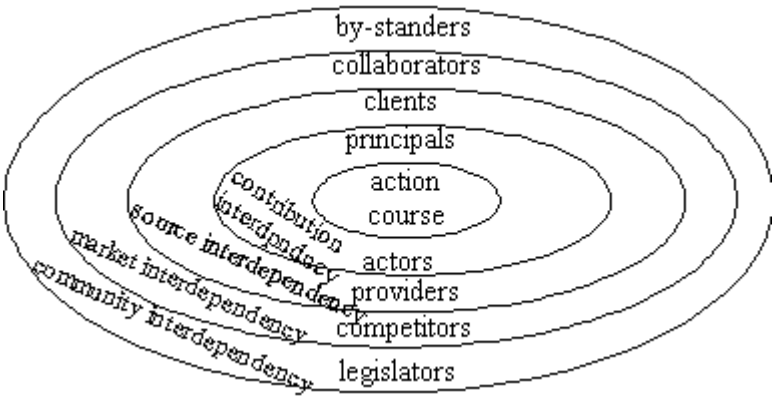

Figure 1: The stakeholder model.

Businesses are currently confronted with dynamic situations that consist of complex, interdependent systems of changing problems that interact with each other. Ackoff (1979) calls such situations as "messes". Systems design in such situations becomes extremely difficult because it cannot be done only by a team of technologist. It will require participation of many parties. The multiple stakeholders involved will have different

perspectives of the goals and objectives to be achieved through the system design. Identifying the stakeholders and taking into account their perspectives are essential for producing a quality system design.

This paper reflects an on-going research project aiming at developing a set of problem analysis and specification methods specifically for information systems development. The Problem Articulation Method (PAM) (Kolkman 1995) is adopted and expanded in order to identify stockholders in information systems design, and further to analyse the whole task of systems design into a set of subtasks and the relationship between the subtasks. These analyses are considered as a necessary foundation for cooperative systems design.

Method for Problem Analysis

The complex nature of the cooperative systems design requires a powerful method for analysing and structuring the problem situation in which a series of tasks take place. "Soft" systems approaches are considered appropriate for structuring and analysing problems in information systems design. PAM is one of the Soft methods with a "shaper edge" (Stamper and Kolkman, 1991) by offering a set of analytical and representational techniques. This method is developed from Stamper's norm-based approach (Stamper, 1985) with a philosophical root in Peircean semiotics. The method is designed to be universally applicable within the domain of social and business systems and has been applied to a wide range of problems in fields of information systems development, organisational restructuring and new product development.

According to PAM, a problem must be understood and analysed within its context. Understanding and articulating a problem, which may be fuzzy and interrelated with a messy background, is a prerequisite before one attempts to solve it. A complete process of problem articulation can be performed with four PAM techniques, each covering an aspect. However, two of them will be briefly introduced and applied in this project.

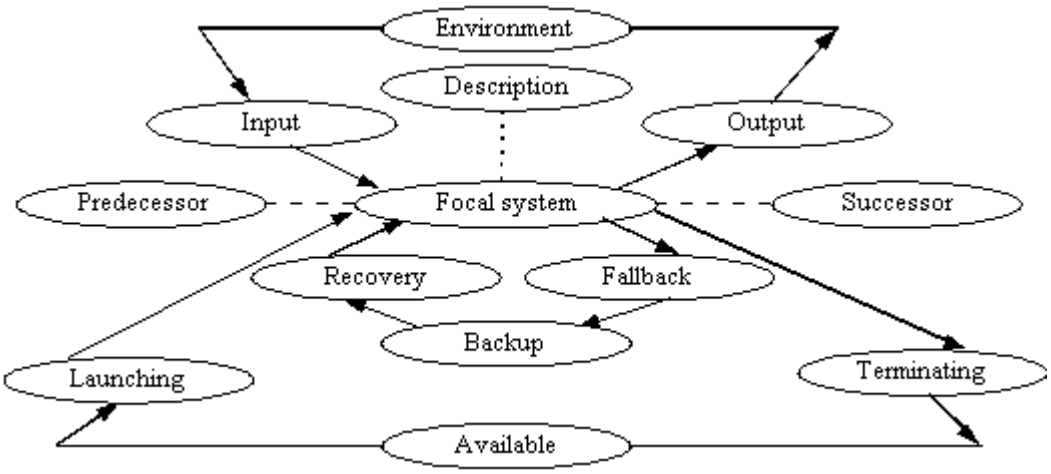

Figure 2: A major part of Collateral Analysis model.

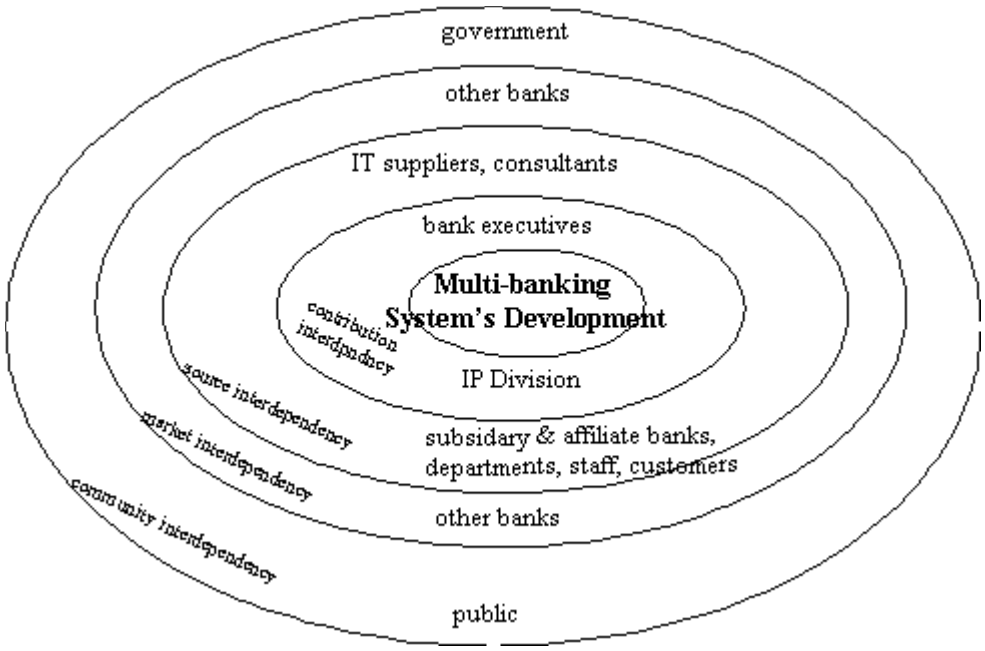

Figure 3. The stakeholders and their relationships.

Unit Systems Definition is a technique which provides handholds to describe a course of action and identify interdependent actors who might take an interest in it (i.e. stakeholders). All courses of action can be defined as unit systems. A course of action can be a simple activity by one person or a complex set of tasks by a group. Each will be identified of its stakeholders, such as the principals, executors, clients, suppliers, competitors, partners and legislators (Figure 1). To identify and record values of the stakeholders to the course of action will be another task in a Unit System Definition. The dynamic aspect of all unit systems is important; therefore each course of action is determined for its start and finish.

Another PAM technique is *Collateral Analysis* (Figure 2) which assists in structuring a problem situation into a number of named units with identified relationships between them. In a total problem situation, there will a focal systems and many collateral systems. The focal system is the unit system that directly contributes to the goals if they are defined, otherwise it is most closely concerned with the definition of goals rather than means. The collateral systems, on the other hand, are those unit systems concerned with means. They surround the focal system and constitute the relevant infrastructure. The added-value of using PAM is when the problem to be dealt with is complex and the situation is messy, by using PAM, one can be reasonably confident about the understanding of the problem, the possible stakeholders, subtasks in terms of subsystems, and relationships between the subsystems.

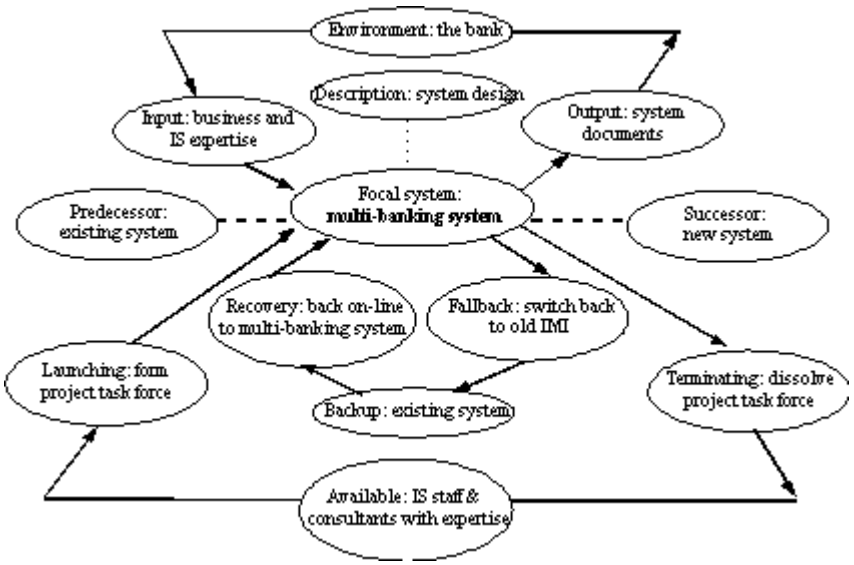

Figure 4: The core course of action and collaterals.

Applying PAM in a Case Study

[This case study is originally based on a US banking company. For information protection reasons, the company is not named and some alterations of the case are made.] The ABC Bank Corporation, an US financial institute, provides all kinds of services such as savings & deposits, lending & leasing, fund transfer & delivery, trusts and accountancy services. Its primary markets are within the state where the headquarters is located although its services extend to outside of the state considerably. There are many subsidiaries and "affiliate" banks (in their term) within the United States; many of them are acquired banks and are spread in different geographic locations. The lead bank has had an information processing (IP) division which was created long time ago to support the ABC as a single banking system. But since early the 1980s, the IP Division had to expand the banking system's scope for multi-banking operations. As the business of the banking corporation has grown so much, the existing system has become inadequate in its functionality and capacity. Evolutionary expansion and modification of the system is not a sound solution any more.

The IP Division has, therefore, been given a task: to form a special Task Group, which liaise with representatives of the potential users, and to produce a specification of requirements and further to produce a functional design of a new multi-banking system which will meet the new business requirements and challenges. As decided by the IP Division, the production of requirements specification and functional design will have to be carried out in a collaborative manner that will encourage the potential users to participate actively in the whole process.

PAM is chosen as a method for analysing and structuring the problem in order for the Task Group to get a clear view of the whole task in a very early stage. Unit Systems Definition of PAM is used to identify the stakeholders and the interdependencies in the development of the new multi-banking system (Figure 3). Each of the four circles in the figure constitutes a contest for the ones nested inside. For example, the core course of

action, *Multi-banking System's Development*, depends on the contributions from the bank executives and the IP Division.

Collateral Analysis guides structuring the problem situation into a number of named units systems - the core course of action, *Multi-banking System's Development*, surrounded by activities which stand beside it. The focal system, its collateral systems and their relationships are described in the collateral model in Figure 4. Each named unit system in the collateral model can further be treated as a focus system, therefore the same model can be applied recursively till a satisfactory level of detail is reached. This helps the development team to identify the relevant sub-tasks and activities, and plan for the necessary course of actions.

Conclusions and Future Research

Information systems design is a complex task that will involve multiple stakeholders. In addition to identification of the stakeholders, PAM can assist systems developers to break the complex problem situation into subsystems in a structured manner. The stakeholder analysis and collateral analysis are particularly useful in developing a large scale and complex system by a group of project participants.

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